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**(54) High Temperature Resistant
Gasketing Material Incorporating
Organic Fibers**

(57) A high temperature resistant compressible sheet material having a thickness of 0.001 to 1 inch is comprised of at least about 5 percent by weight of a high temperature organic fiber (e.g. polyaramid) capable of withstanding at least 900°F; 8 to 65 percent by weight of a crosslinkable elastomer; a crosslinking agent for said elastomer; and 15 to 85

percent by weight of a particulate filler which has been chemically modified to coreact and bond with the elastomer. The material is capable of withstanding service temperatures of at least 500°F and is oil and water resistant. The sheet material is useful in the fabrication of gasketing and heat shields, e.g. for automotive applications.

The sheet may be formed from an aqueous composition of the specified components using standard papermaking apparatus.

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SPECIFICATION

High Temperature Gasketing Material Incorporating Organic Fibers

This invention relates to high temperature resistant compressible sheet material useful as gasketing and heat shields and more particularly to high temperature resistant compressible sheet material using a cross-linked elastomer as the binder.

Flexible compressible sheet material has been extensively used in gasketing applications. Typically, the sheet material has a thickness between 0.001 to 1/4 of an inch for use in the fabrication of gaskets. The sheet material is either used alone or as a component of a composite gasket. For example, a gasket for sealing the base of a carburetor to the intake manifold of an internal combustion engine is formed by placing the sheet material on or between one or two sheets respectively, of thin metal to form a composite gasket. Further, gaskets used in connection with internal combustion engines are sometimes required to withstand extremely high temperatures, i.e. on the order of greater than 500°F and sometimes as much as 900°F. For example, the exhaust manifold gaskets, the supercharger gaskets, the gaskets for exhaust systems and head gaskets and those required in connection with catalytic converters must have high temperature resistance. Further, these gaskets must be resistant to oil and water, both of which will contact the gasket when used in connection with an internal combustion engine. With respect to water resistance, this is a particularly important characteristic when used in the fabrication of water pump gaskets. Further, water resistance becomes an even greater requirement of gasketing material when the gasket is used in connection with marine engines and more particularly in outboard motors.

By far, asbestos has found the most use as the fibrous component in gasketing material primarily because of its high temperature resistance. However, because of the toxicity of asbestos, substitutes have been sought which would effectively eliminate the need to use asbestos in gasketing materials.

Fiberglass in the form of microfibers and ceramic fibers has been utilized in connection with forming compressible sheet materials for use in gasketing material. Further, in order to retain structural integrity during conversion of the sheet material to gasketing and in use, it is necessary to provide a binder which possesses those characteristics.

Typically, these binders are elastomeric in nature. Further, the binders should have some degree of heat resistance since they will come in contact with high temperature environments when placed in service. The sheet material must also be compressible and non-porous to form an effective seal between passages which are in fluid communication.

A high temperature resistant compressible sheet material in accordance with the invention has a thickness of 0.001 to 1 inch and comprises at least 5 percent by weight of a high temperature organic fiber capable of withstanding at least 900°F. Included in the high temperature resistant compressible sheet material are 8 to 65 percent by weight of a cross-linkable elastomer; a cross-linking agent for said elastomer and 15 to 85 percent by weight of a particulate filler which has been chemically modified to coreact with the elastomer. The material is capable of withstanding service temperatures of at least 500°F and is oil and water resistant. The sheet material is useful in the fabrication of gasketing and heat shields.

Sheet material according to the invention is suitably formed on standard papermaking apparatus and maintains its integrity under high temperature conditions and is resistant to both water and oil when used as a gasket.

Sheet material according to the invention may be used as a heat shield to isolate various areas from heat generating sources such as a floor underlay in a car or truck.

Sheet material according to the invention may have a plurality of uses where high temperature characteristics are required.

The binder is constituted of a cross-linked elastomer to provide the required compressibility and integrity to the composite sheet material. The term "elastomer", as used herein, is intended to mean and include both synthetic and natural rubber. "Natural rubber", as used herein, is the elastic solid obtained from the sap or latex of the *Hevea* tree, the major constituent being the homopolymer of 2-methyl-1, 3-butadiene (isoprene). "Synthetic rubber", as used herein, is meant to encompass polymers based upon at least 2 percent of a conjugated unsaturated monomer, the conjugation being in the 1, 3 position in the monomer chain and the final polymer in its uncured state having an extensibility of at least 200 percent and a memory of at least 90 percent when stretched within the extensibility limits and released instantaneously. The conjugated unsaturated monomers which are useful in the preparation of synthetic rubber are, but not limited to chloroprene, butadiene isoprene, cyclopentadiene, dicyclopentadiene, and the like. Other olefins capable of free radical anionic or cationic addition polymerization into the polymer chain with a conjugated unsaturated monomer are useful in forming synthetic rubbers. These olefins are typically monoethylenically unsaturated monomers. "Monoethylenically unsaturated", as used herein, is characterized by the monomer having a $>C=CH_2$ group. These monoethylenically unsaturated monomers are, but not limited to, the acrylic monomers such as methacrylic acid, acrylic acid, acrylonitrile, methacrylonitrile, methylacrylate, methylmethacrylate, ethylacrylate, ethylmethacrylate, acrylamide, and the like; olefinic hydrocarbons

such as ethylene, butylene, propylene, styrene, alpha-methylstyrene and the like, and other functional unsaturated monomers such as vinyl pyridine, vinyl pyrrolidone and the like.

The elastomers preferred in the practice of the invention are those based upon synthetic rubber and containing preferably butadiene and acrylonitrile. It is also preferred that the elastomer have incorporated therein sites for condensation cross-linking. These sites for condensation cross-linking are typically acid groups imparted by acrylic acid, hydroxyl groups imparted by hydroxyethylacrylate, N-methylol groups imparted by N-methylolacrylamide and the like. These condensation cross-linking sites are required in order to condensation interpolymerize the various polymer chains to form a cross-linked network as a tenacious and compressible binder material.

In incorporating the elastomer into the sheet material it is desired that the elastomer be in latex form by means of an anionic surface active agent or emulsifier. Typically, these latices are provided as 40 to 60 percent solids in water. Preferably, a typical latex will have an elongation of between 800 and 1200 in the uncured state and 250 to 750 in the cured state.

Although the elastomers useful in the practice of the invention may be provided with sufficient functional groups to self-cross-link, i.e. cross-link without the addition of other materials, cross-linking agents may be added to provide the required cross-linking characteristics.

Cross-linking agents suitable in the practice of the invention include aldehydes such as formaldehyde, glyoxal, acroliene and the like; synthetic resin precondensates obtained by the reaction of an aldehyde generally with compounds containing nitrogen like dimethylol urea, dimethylolethylene urea, di- and trimethylol triazon, dimethyluron, di and trimethylol melamine and other cyclic or noncyclic, water soluble or non-water soluble precondensates of urea and melamine formaldehyde. The reactive methylol groups may be blocked or partially blocked by alcohols having 1 to 4 carbon atoms. Apart from the above, other known cross-linking agents may be used such as diepoxides and epichlorin derivatives, dichlorophenols, beta substituted diethyl sulfones, sulfonium salts N-methylolacrylamide, methacrylamide and derivatives thereof, diisocyanates and the like. Up to 4 percent of the cross-linking agent may be incorporated into the sheet material. Too much cross-linking agent may render the sheet material too brittle or hard and not provide the required compressibility for the gasket material.

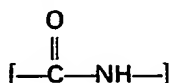
Typically, the elastomeric binder composes about 8 to 65 percent by weight of the sheet material, and more preferably, 8 to 35 percent by weight based on the weight of the sheet material.

In addition to the elastomeric component of the binder a minor amount of non-elastomeric organic addition polymer such as an acrylate may be added to form the binder material, i.e., up to about 30 percent by weight, and more preferably less than 15 percent by weight. It is desirable to limit the amount of non-elastomeric polymer in relation to the elastomer otherwise the final sheet material will not have the required compressibility to be useful in forming gaskets. The non-elastomeric polymer is typically formed by the free radical, anionic or cationic addition polymerization of unsaturated monomers. The unsaturated monomers are monoethylenically unsaturated monomers and characterized as previously described. These monomers are typically acrylic acid, methacrylic acid, acrylonitrile, methacrylonitrile, methylemethacrylate, methylacrylate, ethylacrylate, ethylmethacrylate, acrylamide, N-methylolacrylamide and the like. Preferably, just as in the case of the elastomer, the non-elastomeric polymer may contain the cross-linking groups as previously described. Further, the non-elastomeric polymer is incorporated into the sheet material as a latex which is supplied at a solids level of about 40 to 60 percent by weight in water as an aqueous emulsion.

In a most preferred embodiment of the invention a silane coupling agent having a reactive addition polymerizable double bond may be copolymerized in the elastomer or in the non-elastomeric polymer. Typically, the addition polymerizable silane coupling agents have acrylate or methylacrylate polymerizable groups thereon for incorporation into the binder along with hydrolyzable groups for reaction with the fibrous constituents of the sheet material. Preferably, the silane coupling agents are vinyl triethoxy silane, 8-methacryloxypropyltrimethoxy silane, vinyl tris(beta-methoxyethoxy) silane and the like.

The silane coupling agent monomer should be incorporated into the elastomeric or non-elastomeric polymer at a level of 2 to 15 percent by weight based on the weight of the total binder and more preferably 3 to 12 percent by weight.

The high temperature organic fibers useful in the practice of the invention are those organic fibers capable of withstanding service temperatures of 900°F. Typical high temperature organic fibers are the polyaramid fibers which are polyamides based upon the condensation of aromatic diamines and aromatic dicarboxylic acids and are preferably fibers in which the fiber forming substance is a long chain synthetic polyamide in which at least 85% of the amide



linkages are attached directly to two aromatic rings. A typical polyaramid fiber is sold by E.I. Du Pont De Nemours & Company under the trademark Kevlar®. The high temperature organic fibers are

preferably of staple length. "Staple fibers" are those fibers having a discrete length of up to 8 inches and more preferably up to 4 inches in length and adapted to be processed on standard papermaking equipment.

Most preferably, the high temperature organic fibers are fibrillated which means that the fine fibrils extend from the staple fiber. These fibrils enable the high temperature organic fiber to be dispersed and processed on standard papermaking equipment. Typical high temperature organic fibers and more particularly the aramid fibers, preferably have a fiber length of 0.2 to 12 millimeters and an average length of 1 to 6 millimeters with fibrils having a length of about 3 micrometers to 1 millimeter. Typical fiber diameters are about 12 micrometers and typical fibril diameters are about 0.1 to 1 micrometer. The high temperature organic fiber is incorporated into the compressible sheet material at a level of at least about 5 percent by weight and preferably in a range of 5 to 15 percent by weight. Although other fibers, both organic and inorganic, may be used in forming the high temperature sheet material, it is preferred the major fibrous component be the high temperature organic fiber.

In addition to the high temperature organic fiber, ceramic fibers may be incorporated into the sheet material. These ceramic fibers are formed of metal oxides which are resistant to high temperatures. Typically, the high temperature fibers are composed of alumina, silica, aluminum silicate and combinations thereof along with quartz and the like.

Typically and preferably, the fibrous component constitutes 5 to 25 percent by weight based on the weight of the sheet material and more preferably, 5 to 15 percent by weight based on the weight of the sheet material.

Further, lower temperature inorganic fibers may be used in low levels, preferably below that of the high temperature organic fibers which are capable of withstanding 900°F continuous service temperature, but less than 1500°F continuous service temperatures. Exemplary of these fibers are what are known as glass microfibers, i.e. those having fiber diameters of beta, A, AA, AAA, AAAA, AAAAAA. These glass fibers may be of typical glass compositions known as E-glass, T-glass, C-glass, SF-glass and S-glass as are sold by the Owens Corning Corporation.

These glass fibers can be present in the sheet material at a level of up to 8 percent by weight based on the weight of said material and preferably at less than 5 percent by weight based on the total weight of the material.

The particulate fillers useful in the practice of the invention are those which have been modified to coreact with the cross-linked elastomer. Preferably, these particulate fillers are inorganic in nature and the chemical modification has been by way of a silane coupling agent or Werner complex coupling agent. Typical particulate fillers are clay which can be kaolinite, halloysite, montmorillonite and illite. Other fillers such as quartz, calcite, luminite, gypsum, muscovite and the like may also be used. The clays which have been modified with the coupling agent are those modified by the dual functional coupling agents such as a silicone containing organic compound or Werner complex which establishes a bond with the inorganic filler through the metal atom and a bond with the organic binder through the organic radicals attached to the metal atom. Typically useful modifiers in the form of silane coupling agents are, but not limited to: gamma-aminopropyltriethoxysilane, N-bis(beta-hydroxyethyl)-gamma-aminopropyltriethoxysilane, N-beta(aminoethyl)-gamma-aminopropyltrimethoxysilane, (CH₃O)₃Si(CH₂)₃NH(CH₂)₂NH(CH₂)₂COOCH₃, gamma-glycidoxypolytrimethoxysilane, vinyltriethoxysilane, gamma-methacryloxypropyltrimethoxysilane, vinyltriethoxysilane, vinyl-tris(beta-methoxyethoxy) silane, beta-3, 4-epoxycyclohexyl(ethyltrimethoxy) silane, gamma-thiopropyltrimethoxysilane and the like. Preferably, the coupling agent used to modify the particulate filler is an amino silane or a mercapto silane, and most preferably a mercapto functional silane.

Preferably, the particle size desired in the filler is under 5 microns and preferably a substantial portion thereof under 2 microns, and most preferably under 1 micron. One particularly useful filler has been found to be Nucap 190 which is a mercapto silane functional modified kaolin clay. The particulate filler is incorporated into the sheet material at a level of 15 to 85 percent and more preferably at a level of 40 to 75 percent by weight.

In forming the sheet material of the invention most advantageously standard papermaking apparatus is used such as a fourdrinier, an inclined fourdrinier, a cylinder machine, a rotoformer or the like. A typical process involves charging the fibrous constituents and the filler to a pulper and dispersing them in water. The fibrous component along with the filler is agitated with a major amount of water and a cationic polyelectrolyte in a minor amount is added to the admixture of the fibers and the filler. Typically, the cationic polyelectrolyte is a polymer having free amine groups such as a polyamine or the like. The cationic polyelectrolyte imparts a heavy charge on the fibers causing them to separate and be homogeneously dispersed in the water. To the dispersion is then charged a mixture of the cross-linking agent, if used, and the elastomeric and non-elastomeric emulsions. If a non-elastomeric latex is used which contains a silane coupling agent reacted therein, it should be charged first in order to provide intimate contact of the silane with the surface of the fibers. The elastomer and cross-linking agent are deposited on the surface of the fibers.

An anionic colloid is charged to redisperse the fibers and to form a homogeneous dispersion of fibers having elastomer and non-elastomer and cross-linking agent coated thereon. The fiber dispersion is then charged to the machine chest of a fourdrinier papermaking machine. From the machine chest,

- the homogeneous mixture is piped towards the papermaking machine. Prior to the time it reaches the head box of the papermaking machine, a cationic polyelectrolyte is charged in line preferably at the fan pump to ensure good mixing with the dispersion which causes the coated fibers to flocculate, thus providing a controlled particle size flocculant at the head box. The flocculant is transferred onto the moving wire of the fourdrinier and the water is allowed to drain therefrom. After the draining of the water by gravity, suction is applied to the wet web to further remove water from the web. The web is then pressed between felt rolls and then pressed between a metal roll and a felt roll and dried. The drying temperature required is between 200 and 300°F. During the drying cycle the elastomer is cross-linked and the modified filler is chemically integrated into the sheet material. The sheet material is then calendered to a uniform thickness and is taken up on rolls which can be subsequently unwound and cut into gasketing or other high temperature resistant material. In addition to the constituents previously described, other known materials may be added. For example, Werner complexes of hydrophobic acids may be added to the dispersion to impart hydrophobic properties to the fibers.
- The following examples will further illustrate the process of practicing the invention along with specific compositions useful in forming the sheet material. It will be realised that these processes and materials have been selected for description to illustrate the invention by way of example.

Example 1

	<i>Ingredient</i>	<i>Amount Parts by Weight</i>	<i>Solids (percentage)</i>	
20	Water A	2484		20
	Aramid fiber ¹	9.95	11.8	
	Mercapto silane modified clay	49.98	59.5	
	Glass microfiber ²	1.00	1.19	
25	Lufax 290 ³ (3% dispersion)	15.87	0.56	25
	Poly M 100 ⁴ (48% solids latex)	22.40	12.92	
	Melamine formaldehyde resin ⁵ (67% solids in water)	0.52	0.41	
30	Water B	23		30
	Acrylic/acrylonitrile latex ⁶ (48% solids in water)	22.40	12.92	

¹The aramid fiber is Kevlar® Wet Lap Merge 6F205.

²The glass microfiber is Johns Manville Code 112 microfiber.

³Lufax 290 is a cationic polyelectrolyte sold by Rohm & Haas. 35

⁴Poly M 100 is a latex sold by Polymeric, Inc. having 12% of a hydrolyzable silane acrylate polymerized therein, along with acrylic acid, acrylonitrile, N-methylol acrylamide and an alkyl acrylate and is non-elastomeric.

⁵The melamine formaldehyde resin is sold under the Trade Mark Resimene 842 by Monsanto Co.

⁶The acrylic/acrylonitrile latex is sold by Polymeric, Inc. under the Trade Name Poly M-410. It has an elongation of 1020 uncured and 440 cured and is self-cross-linking. 40

	<i>Ingredient</i>	<i>Amount Parts by Weight</i>	<i>Solids (percentage)</i>	
45	Water C	23		45
	Lufax 290 ⁴	10.77	0.38	
	Deacetylated Karaya gum ⁷ (1% solids in water)	49.3	0.58	

⁷Deacetylated Karaya gum is an anionic colloid.

- The water A along with the aramid fiber and glass microfiber were charged to a pulper and agitated until homogeneous. The mercapto silane modified clay was then added to the pulper and the mixture was again agitated until homogeneous. Agitation was continued in the pulper for the remaining portion of the charging. The following ingredients were added in sequence: the Lufax; a mixture of the Poly M 100 melamine formaldehyde and the water B; a mixture of the acrylic/acrylonitrile latex, and water C; and the deacetylated Karaya gum dispersion.
- After a uniform dispersion had been achieved, the dispersion was pumped to a hand sheet mold. After complete charging to the hand sheet mold, the Lufax solution was added to the dispersion and

the flocculant was formed. Vacuum was applied to form the wet web. The wet web was dried in a felt surface heated press where the felts were at a temperature of about 280°F. The process was carried out to produce a final sheet having a gauge of 0.437 inches. The material had the following characteristics:

5	Property	Value	5
	Basis weight, lbs/480 ft. ²	118.70	
	Basis weight, grms/dcm ²	12.07	
	Density, grms/cc	1.08	
	Tensile, psi	1589.67	
10	Moisture, %	.87	10
	Compression, % @ 5000 psi	27.84	
	Initial recovery, %	21.86	
	% ash	50.96	
	Basis weight, lbs/yd ²	2.22	
15	Density, lbs/ft ³	67.90	15

The compressibility and recovery of the sheet material were measured in accordance with ASTM designation F36—66 (1973). The material was then tested in accordance with ASTM designation F39—59 (1974) at 150°C for 5 hours in No. 3 oil. The results of the tests were as follows:

	% gauge change	3.02	
20	% weight increase	29.35	20
	% compression 5000 psi	25.94	
	% initial recovery	16.80	
	tensile, psi	1312.8	
	% tensile change	-17.42	

25 Example 2

Example 1 was repeated except that 7% aramid fiber was used instead of 11.7% and the glass fiber was eliminated from the formulation. The material prepared in accordance with this Example 2 had the following characteristics:

	Gauge, in.	.0296	
30	Basis wt., lbs/480 ft ²	84.96	30
	Basis wt., grms/dcm ²	8.64	
	Density, lbs/ft ³	71.67	
	Tensile, psi	1152.77	
	Moisture %	.70	
35	Compression % @ 5000 psi	33.08	35
	Initial recovery %	25.83	
	% ash	51.52	

After testing in accordance with ASTM F39—59, the following results were obtained:

	% gauge change	2.71	
40	% weight increase	19.22	40
	% compression 5000 psi	30.91	
	% initial recovery	28.13	
	tensile, psi	1209.86	
	% tensile change	+4.95	

45 The results show the maintenance of tensile strength and other properties after testing the gasket material in oil at high temperature. To the contrary, in normal gasketing materials there is a decrease in strength. Further, the material substantially maintains its compressibility after the oil emersion test which makes it ideal for high temperature gasketing material. 45

50 Further, tests have been run which show that the gasketing material is excellent in marine applications and in high temperature automotive applications. 50

In another application for the heat resistant material of the present invention, it has been found that the material demonstrates insulating characteristics when used as a heat shield and the like in isolating high temperature components from necessarily low temperature operating components in automobiles. Thus, in an automobile, it is an excellent material to provide a heat shield between a catalytic converter which operates at extremely high temperatures to isolate it from the frame and 55

body portions and appurtenant components in the undercarriage of an automobile. Further, it is useful in the firewall of an automobile to isolate the engine compartment from the passenger compartment.

Claims

1. A high temperature resistant compressible sheet material having a thickness of 0.001 to 1 inch comprising:
 - at least about 5 percent by weight of a high temperature organic fiber capable of withstanding at least 900°F;
 - a binder having therein 8 to 65 percent by weight of a cross-linkable elastomer; and
 - a cross-linking agent for said elastomer;
- 15 15 to 85 percent by weight of a particulate filler which has been chemically modified to coreact with said elastomer;
 - said material being capable of withstanding service temperatures of at least 500°F and being oil and water resistant.
2. The material of claim 1, wherein said particulate filler is present at a level of 40 to 70 percent by weight based on the total weight of said material.
3. The material of claim 1, wherein said filler is an inorganic filler.
4. The material of claim 3, wherein said filler is a clay.
5. The material of claim 3, wherein said filler has been modified with a coupling agent.
6. The material of claim 5, wherein said coupling agent is a silane coupling agent.
- 20 7. The material of claim 6, wherein said silane coupling agent is selected from the group consisting of an amino functional silane coupling agent and a mercapto functional silane coupling agent.
8. The material of claim 1 including a silane coupling agent copolymerized with the binder for the sheet material.
- 25 9. The material of claim 8, wherein the silane coupling agent is addition copolymerized with the elastomer.
10. The material of claim 1, wherein said high temperature organic fiber is an aramid fiber.
11. The material of claim 1, wherein said high temperature organic fiber is present at a level of 7 percent by weight or greater.
- 30 12. The material of claim 1 having a thickness of 0.001 to 1/4 inch.
13. The material of claim 1, wherein said high temperature organic fiber is fibrillated.
14. The material of claim 1, wherein said elastomer has acrylonitrile polymerized therein.
15. The material of claim 1, wherein said elastomer is present at a level of 8 to 35 percent by weight based on the weight of said sheet material.
- 35 16. The material of claim 1 including 8 to 30 percent by weight of a cross-linkable non-elastomeric polymer.
17. The material of claim 16 including a silane coupling agent copolymerized with said non-elastomeric polymer.
18. The material of claim 1, wherein said cross-linking agent is selected from the group consisting of melamine formaldehyde resins, urea formaldehyde resins and resorcinol formaldehyde resins.
- 40 19. The material of claim 1, wherein said cross-linking agent is present at a level of 0.7 to 4 percent by weight based on the weight of said material.
20. The material of claim 1, wherein said high temperature staple fibers are polyaramid fibers.
21. The material of claim 1, wherein said high temperature organic fibers are present at a level of 5 to 15 percent by weight based on the weight of said material.
- 45 22. A method of forming a sheet material on papermaking apparatus comprising:
 - dispersing high temperature organic staple fibers and an inorganic filler modified to chemically react with an elastomer in an aqueous media to form a dispersion;
 - 50 adding a cationic polyelectrolyte to said dispersion to impart an ionic charge to said fibers to deposit polymers onto said fibers in the dispersion;
 - adding a cross-linkable elastomeric latex and a cross-linking agent to said dispersion and depositing the elastomer and cross-linking agent on the surface of said fibers;
 - 55 adding an anionic colloid dispersion to separate and disperse the fibers having the elastomer and cross-linking agent deposited thereon;
 - adding a counterionic polyelectrolyte to reflocculate the non-aqueous constituents of said dispersion;
 - 60 forming the flocculant into a wet web;
 - removing the water from said wet web;
 - compressing the web to form a coherent sheet; and
 - drying the sheet to cross-link the elastomer to form a compressible sheet having a thickness of 0.001 to 1 inch.
23. The method of claim 22, wherein said colloid is anionic and said counterionic polyelectrolyte is cationic.

24. The method of claim 22, wherein said inorganic filler is present at a level of 15 to 85 percent by weight based on the total weight of the sheet material.

25. The method of claim 22, wherein said filler is a clay.

26. The method of claim 25, wherein said clay is modified with a silane coupling agent.

5 27. The method of claim 22 including a silane coupling agent addition copolymerized with said elastomer. 5

28. The method of claim 22 including adding a non-elastomeric polymer latex to said dispersion.

29. The method of claim 28, wherein said non-elastomeric polymer has a silane coupling agent addition copolymerized with said polymer.

10 30. A high temperature resistant compressible sheet material substantially as hereinbefore described with reference to either one of Examples 1 and 2. 10

31. A method of forming a sheet material on papermaking apparatus substantially as hereinbefore described with reference to either one of Examples 1 and 2.

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